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<b>(21) International Application Number:</b> PCT/US94/06849 <b>(22) International Filing Date:</b> 16 June 1994 (16.06.94) <b>(30) Priority Data:</b> 08/094,418 19 July 1993 (19.07.93) US 08/250,128 3 June 1994 (03.06.94) US <b>(71) Applicant:</b> THE PROCTER & GAMBLE COMPANY [US/US]; One Procter & Gamble Plaza, Cincinnati, OH 45202 (US). <b>(72) Inventors:</b> STERLING, Marisa, Elizabeth; 26 Foursome Cres- cent, Toronto, Ontario M2P 1W2 (CA). DINNIWELL, Alan, Robert; 5227 Wheatmore Court, Mason, OH 45040 (US). <b>(74) Agents:</b> REED, T., David et al.; The Procter & Gamble Company, 5299 Spring Grove Avenue, Cincinnati, OH 45202 (US).		<b>(81) Designated States:</b> AU, BB, BG, BR, BY, CA, CN, CZ, FI, GE, HU, JP, KG, KP, KR, KZ, LK, LV, MD, MG, MN, MW, NO, NZ, PL, RO, RU, SD, SI, SK, TJ, TT, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> DETERGENT COMPOSITIONS INHIBITING DYE TRANSFER IN WASHING  <b>(57) Abstract</b>  The invention relates to a dye transfer inhibiting composition comprising: (a) dye binding polymers selected from polyvinylpyrrolidone, polyamine N-oxide containing polymer, N-vinylimidazole, N-vinylpyrrolidone copolymer, and mixtures thereof; and (b) polymeric agents selected from alkoxy containing polymers, cellulosic derivatives, and mixtures thereof; where the ratio of polymeric agent to dye binding polymer on a ppm basis delivered in the wash solution is from about 2:1 to about 250:1. The invention also relates to a detergent composition which contains the dye transfer inhibiting composition in addition to surfactants, builders and other conventional detergent ingredients, where the level of dye binding polymer in the detergent composition is from about 0.001 % to about 10 % by weight, and the level of polymeric agent in the detergent composition is from about 0.1 % to about 15 % by weight. The amount of dye binding polymer delivered in the wash solution is from about 0.01 ppm to about 120 ppm, and the amount of polymeric agent delivered in the wash solution is from about 1 ppm to about 100 ppm.		

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## DETERGENT COMPOSITIONS INHIBITING DYE TRANSFER IN WASHING

### Related Application

### Field of the Invention

The present invention relates to a composition for inhibiting dye transfer between fabrics during washing.

### Background of the Invention

One of the most persistent and troublesome problems arising during modern fabric laundering operations is the tendency of some colored fabrics to release dye into the laundering solutions. The dye can then be transferred onto other fabrics being washed therewith.

Polyvinylpyrrolidone and other dye binding polymers have been used to inhibit dye transfer between fabrics during laundering operations. However, it has now been found that certain polymeric agents such as polyethylene glycol or carboxymethylcellulose combined with certain dye binding polymers, in specific ratios, provide an unexpected improvement in the dye transfer inhibition performance of detergent compositions. This combination of ingredients is very effective in reducing the amount of dye transfer that occurs during a laundering operation.

Accordingly, the present invention provides a dye transfer inhibiting composition which exhibits optimum dye transfer inhibiting properties.

### Summary of the Invention

The invention relates to a dye transfer inhibiting composition comprising: (a) dye binding polymers selected from polyvinylpyrrolidone, polyamine N-oxide containing polymer, N-vinylimidazole N-vinylpyrrolidone copolymer, and mixtures thereof; and (b) polymeric agents selected from alkoxy containing polymers, cellulosic derivatives, and mixtures thereof, where the ratio of polymeric agent to dye binding polymer on a ppm basis delivered in the wash solution is from about 2:1 to about 250:1. The invention also relates to a detergent composition which contains the dye transfer inhibiting composition in addition to surfactants, builders and other conventional detergent ingredients, where the level of dye binding polymer in the detergent composition is from about 0.001% to about 10% by weight, and the level of polymeric agent in the detergent composition is from about 0.1% to about 15% by weight. The amount of dye binding polymer delivered in the wash solution is from about 0.01 ppm to about 120 ppm, and the amount of polymeric agent delivered in the wash solution is from about 1 ppm to about 100 ppm.

### Detailed Description of the Invention

It has now been discovered that the combination of certain polymeric agents and certain dye binding polymers, in specific ratios, delivers unexpectedly improved dye transfer inhibition relative to the dye binding polymers alone. As a result, the dye transfer inhibition performance of a detergent composition can be dramatically enhanced.

The dye binding polymers are selected from polyvinylpyrrolidone, polyamine N-oxide containing polymer, N-vinylimidazole N-vinylpyrrolidone copolymer, and mixtures thereof. These dye binding polymers are described in more detail hereinbelow.

#### Polyvinylpyrrolidone

The dye binding polymer can be a polyvinylpyrrolidone ("PVP") having an average molecular weight of from about 5,000 to about 400,000, preferably from about 5,000 to about 200,000, more preferably from about 5,000 to about 50,000, and most preferably from about 5,000 to about 20,000. Suitable polyvinylpyrrolidones are commercially available from GAF Corporation, New York, NY and Montreal, Canada under the product names PVP K-15 (average molecular weight of 10,000), PVP K-30 (average molecular weight of 40,000), PVP K-60 (average molecular weight of 160,000), and PVP K-90 (average molecular weight of 360,000). PVP K-15 is also available from ISP Corporation. Polyvinylpyrrolidones are known to persons skilled in the detergent field; see, for example, EP-A-262,897 and EP-A-256,696. The amount of polyvinylpyrrolidone used in the present detergent compositions is preferably from about 0.001% to about 5% by weight of the detergent, more preferably from about 0.01% to about 4% by weight, more preferably from about 0.05% to about 3% by weight, and most preferably from about 0.1% to about 2% by weight. The amount of polyvinylpyrrolidone delivered in the wash solution is preferably from about 0.1 ppm to about 75 ppm, more preferably from about 0.5 ppm to about 50 ppm, and most preferably from about 1 ppm to about 25 ppm.

#### Polyamine N-Oxide Containing Polymer

The dye binding polymer can also be a polyamine N-oxide containing polymer which contains units having the following structure formula (I):



wherein P is a polymerisable unit, whereto the R-N-O group can be attached or wherein the R-N-O group forms part of the polymerisable unit or a combination of

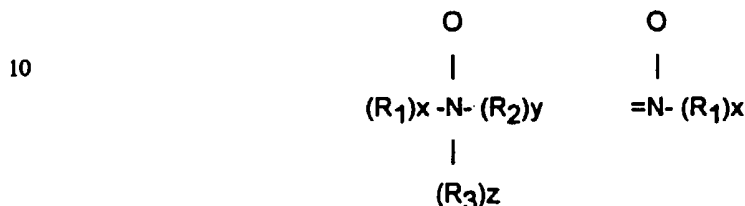
both;



wherein A is NC, CO, C, -O-, -S-, or -N-; x is 0 or 1; and

- 5 wherein R are aliphatic, ethoxylated aliphatics, aromatic, heterocyclic or alicyclic groups or any combination thereof whereto the nitrogen of the N-O group can be attached or wherein the nitrogen of the N-O group is part of these groups.

The N-O group can be represented by the following general structures:



- 15 wherein  $R_1$ ,  $R_2$ , and  $R_3$  are aliphatic groups, aromatic, heterocyclic or alicyclic groups or combinations thereof, x and/or y and/or z is 0 or 1 and wherein the nitrogen of the N-O group can be attached or wherein the nitrogen of the N-O group forms part of these groups.

The N-O group can be part of the polymerisable unit (P) or can be attached to the polymeric backbone or a combination of both.

- 20 Suitable polyamine N-oxides wherein the N-O group forms part of the polymerisable unit comprise polyamine N-oxides wherein R is selected from aliphatic, aromatic, alicyclic or heterocyclic groups.

- One class of said polyamine N-oxides comprises the group of polyamine N-oxides wherein the nitrogen of the N-O group forms part of the R-group. Preferred  
25 polyamine N-oxides are those wherein R is a heterocyclic group such as pyridine, pyrrole, imidazole, pyrrolidine, piperidine, quinoline, acridine and derivatives thereof.

- Another class of said polyamine N-oxides comprises the group of  
polyamine N-oxides wherein the nitrogen of the N-O group is attached to the R-  
30 group.

- Other suitable polyamine N-oxides are the polyamine oxides whereto the N-O group is attached to the polymerisable unit. A preferred class of these polyamine N-oxides are the polyamine N-oxides having the general formula (I) wherein R is an aromatic, heterocyclic or alicyclic group wherein the nitrogen of  
35 the N-O functional group is part of said R group.

Examples of this class are polyamine oxides wherein R is a heterocyclic compound such as pyridine, pyrrole, imidazole and derivatives thereof.

Another preferred class of polyamine N-oxides are the polyamine oxides having the general formula (I) wherein R are aromatic, heterocyclic or alicyclic

groups wherein the nitrogen of the N-O functional group is attached to said R groups.

Examples of this class are polyamine oxides wherein R groups can be aromatic such as phenyl.

5 Any polymer backbone can be used as long as the amine oxide polymer formed is water-soluble and has dye transfer inhibiting properties. Examples of suitable polymeric backbones are polyvinyls, polyalkylenes, polyesters, polyethers, polyamide, polyimides, polyacrylates and mixtures thereof.

10 The polyamine N-oxide containing polymers of the present invention typically have a ratio of amine to the amine N-oxide of 10:1 to 1:1000000. However the amount of amine oxide groups present in the polyamine N-oxide containing polymer can be varied by appropriate copolymerization or by appropriate degree of N-oxidation. Preferably, the ratio of amine to amine N-oxide is from 2:3 to 1:1000000. More preferably from 1:4 to 1:1000000, most preferably  
15 from 1:7 to 1:1000000. The polymers of the present invention actually encompass random or block copolymers where one monomer type is an amine N-oxide and the other monomer type is either an amine N-oxide or not. The amine oxide unit of the polyamine N-oxides has a  $PK_a < 10$ , preferably  $PK_a < 7$ , more preferred  $PK_a < 6$ .

20 The polyamine N-oxide containing polymer can be obtained in almost any degree of polymerization. The degree of polymerization is not critical provided the material has the desired water-solubility and dye-suspending power.

Typically, the average molecular weight of the polyamine N-oxide containing polymer is within the range of 500 to 1,000,000; preferably from 1,000  
25 to 50,000, more preferably from 2,000 to 30,000, most preferably from 3,000 to 20,000.

The amount of polyamine N-oxide containing polymer used in the present detergent compositions is preferably from about 0.005% to about 5% by weight of the detergent, more preferably from about 0.01% to about 3% by weight, and most  
30 preferably from about 0.02% to about 1.6% by weight. The amount of polyamine N-oxide containing polymer delivered in the wash solution is preferably from about 0.01 ppm to about 30 ppm, more preferably from about 0.05 ppm to about 20 ppm, more preferably from about 0.1 ppm to about 10 ppm, and most preferably from about 0.1 ppm to about 5 ppm.

35 **N-vinylimidazole N-vinylpyrrolidone Copolymer**

The dye binding polymer can also be an N-vinylimidazole N-vinylpyrrolidone copolymer having an average molecular weight range from about 5000-1,000,000, preferably from about 20,000-200,000. Highly preferred polymers having an excellent overall detergency performance have an average

molecular weight range from 5,000 to 50,000 more preferably from 8,000 to 30,000, most preferably from 10,000 to 20,000. The average molecular weight range was determined by light scattering as described in Barth H.G. and Mays J. W. Chemical Analysis Vol. 113 "Modern Methods of Polymer Characterization".

5       The N-vinylimidazole N-vinylpyrrolidone copolymer of the present invention has a molar ratio of N-vinylimidazole to N-vinylpyrrolidone from 1 to 0.2, more preferably from 0.8 to 0.3, most preferably from 0.6 to 0.4. The N-vinylimidazole N-vinylpyrrolidone copolymers can be linear or branched.

10       The amount of N-vinylimidazole N-vinylpyrrolidone polymer used in the present detergent compositions is preferably from about 0.005% to about 5% by weight of the detergent, more preferably from about 0.01% to about 3% by weight, and most preferably from about 0.02% to about 1.6% by weight. The amount of N-vinylimidazole N-vinylpyrrolidone polymer delivered in the wash solution is  
15 ppm to about 20 ppm, more preferably from about 0.1 ppm to about 10 ppm, and most preferably from about 0.1 ppm to about 5 ppm.

20       The polymeric agents which are combined with the dye binding polymers in the present compositions are selected from alkoxy containing polymers, cellulosic derivatives, and mixtures thereof. These polymeric agents are described in more detail hereinbelow.

#### Alkoxy Containing Polymers

25       The alkoxy containing polymers (i.e., polymers having alkoxy moieties) can include copolymeric blocks of ethylene terephthalate and polyethylene oxide or polypropylene oxide terephthalate and the like. The most preferred alkoxy containing polymers include polyethylene glycol or polypropylene glycol and derivatives thereof. Particularly preferred is polyethylene glycol ("PEG") having an average molecular weight from about 500 to about 100,000, preferably from about 1,000 to about 50,000, more preferably from about 1,500 to about 10,000, and most preferably from about 1,500 to about 4,000. Polyethylene glycol is prepared  
30 in a known manner by subjecting ethylene glycol to a polycondensation process; thus, the polyethylene glycol may be regarded as the condensation polymer of ethylene oxide or ethylene glycol with water. The general structure is:  $\text{HO}-(\text{CH}_2-\text{CH}_2-\text{O})_n-\text{H}$ . Suitable polyethylene glycols are commercially available from Union Carbide Chemicals and Plastics Co., Inc., Danbury, CT. The polyethylene glycol  
35 can be added as a separate ingredient or as part of a combined ingredient (e.g., a co-flake containing about 99% polyethylene glycol and about 1% suds suppressor).

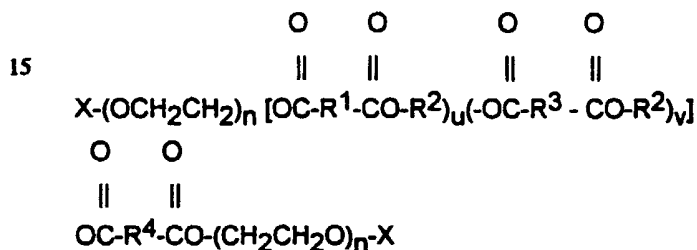
Another suitable alkoxy containing polymer is a copolymer having random blocks of ethylene terephthalate and polyethylene oxide (PEO) terephthalate. More

specifically, these polymers are comprised of repeating units of ethylene terephthalate and PEO terephthalate in a mole ratio of ethylene terephthalate units to PEO terephthalate units of from 25:75 to 35:65, said PEO terephthalate units containing polyethylene oxide having molecular weights of from 300 to 2000.

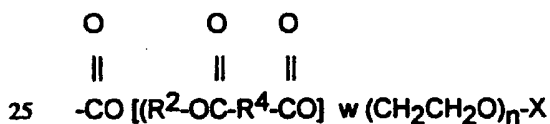
5 The molecular weight of this polymer is in the range of from 3,000 to 55,000.

Another suitable alkoxy containing polymer is a polyester with repeating units of ethylene terephthalate containing 10-15% by weight of ethylene terephthalate units together with 90-80% by weight of polyoxyethylene terephthalate units, derived from a polyoxyethylene glycol of average molecular  
10 weight 300-5,000, and the mole ratio of ethylene terephthalate units to polyoxyethylene terephthalate units in the polymeric compound is between 2:1 and 6:1.

Other alkoxy containing polymers are compounds of formula:



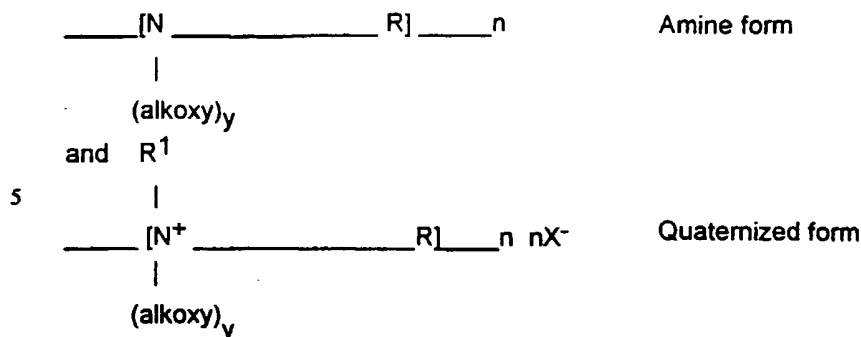
20 wherein the  $\text{R}^1$  moieties are all 1,4-phenylene moieties; the  $\text{R}^2$  moieties are essentially ethylene moieties, 1,2-propylene moieties or mixtures thereof; the  $\text{R}^3$  moieties are substituted 1,3-phenylene moieties having the substituent



at the 5 position; the  $\text{R}^4$  moieties are  $\text{R}^1$  or  $\text{R}^3$  moieties, or mixtures thereof; each X is ethyl or preferably methyl; each n is from 12 to 43; when w is 0, u + v is from 3 to 10; when w is at least 1, u + v + w is from 3 to 10. Preferred block polyesters are those where v is 0, i.e. the linear block polyesters. For these preferred linear  
30 block polyesters, u typically ranges from 3 to 8, especially for those made from dimethyl terephthalate, ethylene glycol (or 1,2-propylene glycol) and methyl capped polyethylene glycol. The most water soluble of these linear block polyesters are those where u is from 3 to 5.

Other alkoxy containing polymers suitable for the present invention are  
35 alkoxyated polyamines. Such materials can conveniently be represented as molecules of the empirical structures with repeating units:





Wherein R is a hydrocarbyl group, usually of 2-6 carbon atoms; R<sup>1</sup> may be a C<sub>1</sub>-  
 10 C<sub>20</sub> hydrocarbon; the alkoxy groups are ethoxy, propoxy, and the like, and y is 2-30, most preferably from 10-20; n is an integer of at least 2, preferably from 2-20, most preferably 3-5; and X<sup>-</sup> is an anion such as halide or methylsulfate, resulting from the quaternization reaction.

The amount of alkoxy containing polymers used in the present detergent  
 15 compositions is preferably from about 0.2% to about 8% by weight of the detergent, more preferably from about 0.3% to about 6% by weight, and most preferably from about 0.4% to about 4% by weight. The amount of alkoxy containing polymers delivered in the wash solution is preferably from about 3 ppm to about 90 ppm, more preferably from about 5 ppm to about 80 ppm, and most  
 20 preferably from about 10 ppm to about 70 ppm.

#### Cellulosic Derivatives

The cellulosic derivatives for use as polymeric agents in the present dye transfer inhibiting compositions are water-soluble cellulosic derivatives which include the alkali metal salts of a carboxy lower alkyl cellulose having up to 3  
 25 carbons in the alkyl group, such as the sodium and potassium salts of carboxymethylcellulose or of carboxyethylcellulose. Sodium carboxymethylcellulose is preferred. Suitable water-soluble cellulosic derivatives also include the lower alkyl cellulose ethers, e.g., methyl cellulose and ethyl cellulose; hydroxyalkyl cellulose ethers, e.g., hydroxyethyl cellulose; cellulose  
 30 ethane sulfonic acid; and cellulose glycolic acid.

The amount of cellulosic derivatives used in the present detergent compositions is preferably from about 0.2% to about 8% by weight of the detergent, more preferably from about 0.3% to about 6% by weight, and most preferably from about 0.4% to about 4% by weight. The amount of cellulosic  
 35 derivatives delivered in the wash solution is preferably from about 3 ppm to about 90 ppm, more preferably from about 5 ppm to about 80 ppm, and most preferably from about 10 ppm to about 70 ppm.

As discussed above, it has surprisingly been discovered that by combining the polymeric agents with the dye binding polymers in certain ratios, an

unexpected improvement in dye transfer inhibition is obtained. The ratio of polymeric agent to dye binding polymer on a ppm basis delivered in the wash solution is from about 2:1 to about 250:1. When polyvinylpyrrolidone is used as the dye binding polymer, the ratio of polymeric agent to dye binding polymer on a ppm basis delivered in the wash solution is preferably from about 2:1 to about 50:1, more preferably from about 3:1 to about 20:1, more preferably from about 3:1 to about 10:1, and most preferably from about 4:1 to about 8:1. When polyamine N-oxide containing polymer and/or N-vinylimidazole N-vinylpyrrolidone copolymer are used as the dye binding polymer, the ratio of polymeric agent to dye binding polymer on a ppm basis delivered in the wash solution is preferably from about 3:1 to about 150:1, more preferably from about 3:1 to about 100:1, and most preferably from about 4:1 to about 75:1.

The present dye transfer inhibiting compositions are conveniently used as additives to conventional detergent compositions for use in laundry operations. The present invention also encompasses detergent compositions containing the dye transfer inhibiting compositions along with conventional detergent ingredients.

#### Detergent Ingredients

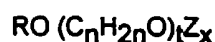
A wide range of surfactants can be used in the detergent compositions. A typical listing of anionic, nonionic, ampholytic and zwitterionic classes, and species of these surfactants, is given in U.S. Patent 3,664,961 issued to Norris on May 23, 1972.

Mixtures of anionic surfactants are particularly suitable herein, especially mixtures of sulphonate and sulphate surfactants in a weight ratio of from 5:1 to 1:2, preferably from 3:1 to 2:3, more preferably from 3:1 to 1:1. Preferred sulphonates include alkyl benzene sulphonates having from 9 to 15, especially 11 to 13 carbon atoms in the alkyl radical, and the alpha-sulphonated methyl fatty acid esters in which the fatty acid is derived from a C<sub>12</sub>-C<sub>18</sub> fatty source, preferably from a C<sub>16</sub>-C<sub>18</sub> fatty source. In each instance the cation is an alkali metal, preferably sodium. Preferred sulphate surfactants are alkyl sulphates having from 12 to 18 carbon atoms in the alkyl radical, optionally in admixture with ethoxy sulphates having from 10 to 20, preferably 10 to 16 carbon atoms in the alkyl radical and an average degree of ethoxylation of 0.1 to 9. Examples of preferred alkyl sulphates herein are tallow alkyl sulphate, coconut alkyl sulphate, and C<sub>14-15</sub> alkyl sulphates. The cation in each instance is again an alkali metal cation, preferably sodium.

One class of nonionic surfactants useful in the present invention are condensates of ethylene oxide with a hydrophobic moiety to provide a surfactant having an average hydrophilic-lipophilic balance (HLB) in the range from 8 to 17, preferably from 9.5 to 13.5, more preferably from 10 to 12.5. The hydrophobic

(lipophilic) moiety may be aliphatic or aromatic in nature and the length of the polyoxyethylene group which is condensed with any particular hydrophobic group can be readily adjusted to yield a water-soluble compound having the desired degree of balance between hydrophilic and hydrophobic elements. Especially preferred nonionic surfactants of this type are C<sub>9</sub>-C<sub>15</sub> primary alcohol ethoxylates containing 3-9 moles of ethylene oxide per mole of alcohol, particularly the C<sub>14</sub>-C<sub>15</sub> primary alcohols containing 6-9 moles of ethylene oxide per mole of alcohol and the C<sub>12</sub>-C<sub>15</sub> primary alcohols containing 3-9 moles of ethylene oxide per mole of alcohol.

Another class of nonionic surfactants comprises alkyl polyglucoside compounds of general formula



wherein Z is a moiety derived from glucose; R is a saturated hydrophobic alkyl group that contains from 12 to 18 carbon atoms; t is from 0 to 10 and n is 2 or 3; x is from 1.3 to 4, the compounds including less than 10% unreacted fatty alcohol and less than 50% short chain alkyl polyglucosides. Compounds of this type and their use in detergent are disclosed in EP-B 0,070,077, 0,075,996 and 0,094,118.

Also suitable as nonionic surfactants are polyhydroxy fatty acid amide surfactants of the formula



wherein R<sup>1</sup> is H, or R<sup>1</sup> is C<sub>1-4</sub> hydrocarbyl, 2-hydroxy ethyl, 2-hydroxy propyl or a mixture thereof, R<sup>2</sup> is C<sub>5-31</sub> hydrocarbyl, and Z is a polyhydroxyhydrocarbyl having a linear hydrocarbyl chain with at least 3 hydroxyls directly connected to the chain, or an alkoxyated derivative thereof. Preferably, R<sup>1</sup> is methyl, R<sup>2</sup> is a straight C<sub>11-15</sub> alkyl or alkenyl chain such as coconut alkyl or mixtures thereof, and Z is derived from a reducing sugar such as glucose, fructose, maltose, lactose, in a reductive amination reaction.

The compositions according to the present invention may further comprise a builder system. Any conventional builder system is suitable for use herein including aluminosilicate materials, phosphates, silicates, polycarboxylates, fatty acids, materials such as ethylenediamine tetraacetate, and metal ion sequestrants such as aminopolyphosphonates.

Suitable builders can be an inorganic ion exchange material, commonly an inorganic hydrated aluminosilicate material, more particularly a hydrated synthetic zeolite such as hydrated zeolite A, X, B or HS.

Another suitable inorganic builder material is layered silicate, e.g., SKS-6 (Hoechst). SKS-6 is a crystalline layered silicate consisting of sodium silicate

( $\text{Na}_2\text{Si}_2\text{O}_5$ ).

Suitable polycarboxylate builders for use herein include nitrilotriacetate (NTA); ethylenediaminetetracetic acid (EDTA); citric acid, preferably in the form of a water-soluble salt; and derivatives of succinic acid of the formula  $\text{R}-\text{CH}(\text{COOH})\text{CH}_2(\text{COOH})$  wherein R is  $\text{C}_{10-20}$  alkyl or alkenyl, preferably  $\text{C}_{12-16}$ , or wherein R can be substituted with hydroxyl, sulfo sulfoxyl or sulfone substituents. Specific examples include lauryl succinate, myristyl succinate, palmityl succinate, 2-dodecenylsuccinate, 2-tetradecenyl succinate. Succinate builders are preferably used in the form of their water-soluble salts, including sodium, potassium, ammonium and alkanolammonium salts.

Especially for the liquid execution herein, suitable fatty acid builders for use herein are saturated or unsaturated  $\text{C}_{10-18}$  fatty acids, as well as the corresponding soaps. Preferred saturated species have from 12 to 16 carbon atoms in the alkyl chain. The preferred unsaturated fatty acid is oleic acid. Another preferred builder system for liquid compositions is based on dodecenyl succinic acid.

Preferred builder systems for use in granular compositions include a mixture of NTA, phosphate and zeolite.

Other builder materials that can form part of the builder system for use in granular compositions for the purposes of this invention include inorganic materials such as alkali metal carbonates, bicarbonates, silicates, and organic materials such as the organic phosphonates, amino polyalkylene phosphonates and amino polycarboxylates. Other suitable water-soluble organic salts are the homo- or co-polymeric acids of their salts, in which the polycarboxylic acid comprises at least two carboxyl radicals separated from each other by not more than two carbon atoms. Polymers of this type are disclosed in GB-A-1,596,756. Examples of such salts are polyacrylates of MW 2000-5000 and their copolymers with maleic anhydride, such copolymers having a molecular weight of from 20,000 to 70,000, especially about 40,000.

Builders are normally included in amounts of from about 10% to about 80% by weight of the detergent composition, preferably from about 20% to 70%, and more preferably from about 30% to about 60%.

Other components used in detergent compositions may be employed, such as suds boosting or depressing agents, enzymes such as proteases, amylases or lipases, enzyme stabilizers or activators, bleaching agents, soil-suspending agents, soil-release agents, fabric softening agents, optical brighteners, abrasives, bactericides, tarnish inhibitors, coloring agents, and perfumes. Especially preferred are combinations with enzyme technologies which also provide a type of color care benefit, for example cellulase for color maintenance/rejuvenation.

The detergent compositions according to the invention can be in liquid, gel, paste or granular forms. Granular compositions will generally have a density from about 300 g/l to about 900 g/l. "Compact" granular detergents can have a relatively higher density than conventional granular detergents; in such case, the detergent compositions will contain a lower amount of "inorganic filler salt" (e.g., sodium sulfate), compared to conventional granular detergents, typically not more than 20% filler salt.

The present invention also relates to a process for inhibiting dye transfer from one fabric to another of solubilized and suspended dyes encountered during fabric laundering operations involving colored fabrics. The process comprises contacting fabrics with a laundering solution containing the dye transfer-inhibiting composition of this invention. The process of the invention is conveniently carried out in the course of the washing process. The washing process is preferably carried out at 1°C to 90°C, especially 5°C to 60°C. The pH of the treatment solution is preferably from about 7 to about 12, especially from about 8 to about 11.

The following examples are meant to exemplify compositions of the present invention, but are not necessarily meant to limit or otherwise define the scope of the invention, said scope being determined according to claims which follow.

#### Example 1

A granular laundry detergent composition of the present invention is as follows:

<u>Ingredient:</u>	<u>Weight Percent</u>
Crutched	
Sodium C <sub>12-13</sub> linear alkylbenzene sulfonate	12.2%
Sodium C <sub>14-15</sub> alkyl sulfate	12.2%
Tetrasodium pyrophosphate	7.2%
Nitrilotriacetate (active)	19.5%
Sodium carbonate	13.0%
Sodium silicate solids	6.1%
Optical Brightener	0.1%
Zeolites (active)	4.7%
De-Dust	
Condensation product of C <sub>12</sub> -C <sub>13</sub> linear alcohol with 6.5 moles ethylene oxide	0.8%
Dry-Adds	

Polyvinylpyrrolidone	0.5%
Polyethylene glycol	3.9%
Protease enzyme	0.1%
Perfume	0.5%
Zeolites (active)	1.2%
Cellulase enzyme	0.9%

The "crutched" ingredients are mixed together with water in a crutcher to form a paste. This mixture is then spray dried to evaporate the excess moisture and form detergent granules. Then the de-dust is sprayed onto the granules. The "dry-add" ingredients are then admixed to form the finished granular detergent composition.

This composition delivers in the wash solution about 37 ppm polyethylene glycol and about 5.1 ppm polyvinylpyrrolidone (a ratio of about 7.5:1 PEG:PVP).

The pH of a 1% aqueous solution of the detergent composition is 11.

#### Example 2

The following example illustrates the invention and facilitates its understanding.

1. In a Miniwasher pot of 2 U.S. gallons of 35°C water, 61 grams of detergent are added. The mixture is agitated for 1 minute.
2. The dye source is added under agitation and allowed to mix for 1 minute.
3. A total of twelve tracer swatches are added to the Miniwasher pot and washed for 10 minutes. These swatches had previously been balanced by Hunter Colorimeter L,a,b values so that all swatches of a specific type were starting uniformly for each treatment.
4. After the wash cycle is complete, the tracer swatches are rinsed in cold water (7°C).
5. Steps 1-5 are repeated seven times for a total of 8 wash cycles using a new measurement of detergent, a new dye source, and the same 12 tracer swatches for each wash cycle.
6. After wash cycle number 1, 4, and 8 the tracer swatches are dried for 1 hour and then L,a,b readings are taken on the Hunterlab Colorimeter, and a delta E (dE) at that cycle is calculated.

#### Dye Source

C46 Brown Swatch - 3 swatches of 2.5" x 2.5" square are added per pot, per cycle.

#### Tracer Swatches

4 - 86% Cotton/15% Polyester Terry (loop yarn is 100% Cotton)

4 - 100% Cotton Denim

4 - 100% Cotton Interlock T-shirt

Condition

8 grains per gallon water hardness

35°C wash water temperature

5 7°C rinse water temperature

Miniwasher of 2 U.S. gallon capacity

Results

10 The following table shows that when the PVP level is cut by approximately 25% in conjunction with the PEG level being increased by nine times, substantial dye transfer inhibition is achieved. Lower delta E (dE) readings represent less color change from the original fabric color.

**Change in dE on Terry Fabric**

<u>Treatment</u>	<u>PEG 8000</u>	<u>PVP K-15</u>	<u>PEG-PVP</u> <u>Ratio</u>	<u>dE</u>		
				<u>Cycle 1</u>	<u>Cycle 4</u>	<u>Cycle 8</u>
A	5.1ppm	11.75ppm	1:2.3	1.63	7.06	11.52
B	46ppm	8.82ppm	5.2:1	0.81	1.51	3.14

As a result, it appears that PEG:PVP ratios dominated by higher PEG amounts deliver more dye transfer inhibition.

15

**Example 3**

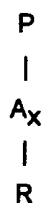
The granular laundry detergent composition of the present invention is made as described in Example 1, except that 3.9% sodium carboxymethylcellulose is used instead of 3.9% polyethylene glycol as the polymeric agent.

1. A dye transfer inhibiting composition comprising: (a) dye binding polymers selected from polyvinylpyrrolidone, polyamine N-oxide containing polymer, N-vinylimidazole N-vinylpyrrolidone copolymer, and mixtures thereof; and (b) polymeric agents selected from alkoxy containing polymers, cellulosic derivatives, and mixtures thereof; wherein the ratio of polymeric agent to dye binding polymer on a ppm basis delivered in the wash solution is from 2:1 to 250:1.
2. A dye transfer inhibiting composition according to Claim 1 wherein the polymeric agent is selected from the group consisting of polyethylene glycol, carboxymethylcellulose, and mixtures thereof.
3. A dye transfer inhibiting composition according to Claim 1 wherein the dye binding polymer is polyvinylpyrrolidone, and wherein the ratio of polymeric agent to dye binding polymer on a ppm basis delivered in the wash solution is from 2:1 to 50:1.
4. A dye transfer inhibiting composition according to Claim 1 wherein the dye binding polymer is selected from the group consisting of polyamine N-oxide containing polymers, N-vinylimidazole N-vinylpyrrolidone copolymers, and mixtures thereof, and wherein the ratio of polymeric agent to dye binding polymer on a ppm basis delivered in the wash solution is from 3:1 to 150:1.
5. A detergent composition which comprises a dye transfer inhibiting composition according to Claim 1 and which further comprises surfactants, builders and other conventional detergent ingredients; wherein the amount of dye binding polymer in the detergent composition is from 0.01% to 10% by weight, and the amount of polymeric agent in the detergent composition is from 0.1% to 15% by weight; and wherein the amount of dye binding polymer delivered in the wash solution is from 0.01 ppm to 120 ppm, and the amount of polymeric agent delivered in the wash solution is from 1 ppm to 100 ppm.
6. A detergent composition according to Claim 5 wherein the amount of polymeric agent in the detergent composition is from 0.2% to 8% by weight, and the amount of polymeric agent delivered in the wash solution is from 3 ppm to 90 ppm.
7. A detergent composition according to Claim 5 wherein the dye binding polymer is polyvinylpyrrolidone, the amount of dye binding polymer in the detergent composition is from 0.001% to 5% by weight, and the amount of dye binding polymer delivered in the wash solution is from 0.1 ppm to 75 ppm.
8. A detergent composition according to Claim 5 wherein the dye binding polymer is selected from the group consisting of polyamine N-oxide

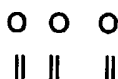


containing polymers, N-vinylimidazole N-vinylpyrrolidone copolymers, and mixtures thereof, the amount of dye binding polymer in the detergent composition is from 0.005% to 5% by weight, and the amount of dye binding polymer delivered in the wash solution is from 0.01 ppm to 30 ppm.

9. A dye transfer inhibiting composition according to Claim 1 wherein the polyamine N-oxide containing polymer contains units having the following structural formula:



wherein P is a polymerisable unit, whereto the R-N-O group can be attached or wherein the R-N-O group forms part of the polymerisable unit or a combination of both;



wherein A is NC, CO, C, -O-, -S-, or -N-; x is 0 or 1; and

wherein R are aliphatic, ethoxylated aliphatic, aromatic, heterocyclic or alicyclic groups or any combination thereof whereto the nitrogen of the N-O group can be attached or wherein the nitrogen of the N-O group is part of these groups.

10. A dye transfer inhibiting composition according to Claim 1 wherein the N-vinylimidazole N-vinylpyrrolidone copolymer has an average molecular weight from 5,000 to 1,000,000.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 94/06849

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 C11D3/37 C11D3/22

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 256 696 (UNILEVER PLC ET AL) 24 February 1988 cited in the application see page 2, line 6 - page 3, line 45; examples 1-5	1-3
P,X	EP,A,0 581 753 (THE PROCTER & GAMBLE COMPANY) 2 February 1994 see page 2, line 35 - page 6, line 25; examples 1-2	1-4,9
X	GB,A,2 137 221 (COLGATE-PALMOLIVE COMPANY) 3 October 1984 see page 1, line 35 - page 3, line 24 see page 4, line 30 - page 5, line 48; example 1	1,3,5-7
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- "&" document member of the same patent family

Date of the actual completion of the international search

19 September 1994

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Intern    3rd Application No  
PCT/US 94/06849

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